The Unique Influence of Executive Functioning and Grit on Goal-Oriented Behaviours

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I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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Abstract

Within the social psychology literature, four different behaviours have been highlighted as playing a particularly salient role in goal-motivation: promotion, prevention, locomotion, and assessment. Personality traits and cognitive skills also have been examined in relation to goal-motivated behaviours; however, these literatures have remained curiously separate. As such, the overarching goal of this work was to examine how aspects of personality and cognition uniquely and jointly contribute to goal motivation and, by extension, to examine the impact of goal-motivation on real-world outcomes in a young adult sample. Study 1 examined goal-motivation in relation to grit, a personality trait that influences perseverance and passion when pursing long-term goals, and executive functioning, a collection of cognitive skills that are used for the purpose of goal-attainment. Study 2 extended this work by incorporating neuroticism as another predictor of goal-motivated behaviours, and by examining the direct and indirect effects of these behaviours on the affective experiences and academic accomplishments of an undergraduate population. Across the two studies, it was generally observed that grit uniquely predicted behaviours that are concerned with taking action to move toward a goal (i.e., promotion and locomotion), whereas executive functioning predicted preventative behaviours that ensure a goal is not compromised (i.e., prevention). The outcome measures of affect and GPA were predicted by the predictor variables of neuroticism, executive functioning, and grit, as well as by the goal-motivated behaviours that were examined. Overall, the findings of this work suggest that personality traits and cognition make unique contributions to goal-oriented behaviours in young adulthood and have important implications for both affective and academic outcomes in this age group.

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CHAPTER 1: Literature Review

How we achieve our goals is of great interest to many people. A large industry has been created around these concerns, outlining habits of successful people, suggesting tips to become more focused, and demonstrating how to turn passion into success. Unsurprisingly, goal-directed behaviour has also been a large focus of research, particularly in the social psychology literature, in which behaviours that allow for (and deter from) goal achievement have been examined.

Within this literature, goal-directed behaviour has mainly been defined as movement toward a desired end-state (Gollwitzer, 1990). In other words, behaviours are engaged in with the purpose of moving closer to the goal to be achieved. However, it is uncommon to have one simple goal; rather, people tend to have multiple goals they are hoping to achieve at one given time. One study examined the factors that allow us to prioritize one goal over another (Schmidt & DeShon, 2007). In this study it was observed that if one task is associated with higher reward value than another, then that task will, unsurprisingly, be prioritized. More interesting was the finding for conditions in which reward was equivalent across tasks. In this case, near the beginning of the study effort was put toward the task that was currently the least successful. As the end of the study drew nearer, this behaviour switched, so that more effort was put toward the more successful task. These authors concluded that if rewards are equivalent across goals, effort will be put toward the least successful goal, provided there is time for this goal to still be achieved (Schmidt & DeShon, 2007).

Another group of researchers examined goal shielding behaviour, or the ability to pursue one goal without getting distracted by other goals. Specifically, their work empirically demonstrated the automatic and implicit nature of goal shielding, which had previously been simply assumed (Shah, Friedman, & Kruglanski, 2002). Moreover, this study showed that the

ability to goal shield varies depending on an individual's "tenacity", or ability to stay focused on a goal. Specifically, it was observed that individuals with high self-reported tenacity produced greater goal-shielding behaviour than those with low self-reported tenacity (Shah et al., 2002). More interesting, for individuals with high tenacity, goal shielding was greater for high-priority goals than lower-priority goals; this difference was not found for those with low tenacity. Thus, Shah et al. (2002) demonstrated that not only is goal shielding an automatic behaviour, but the ability to do so varies across individuals and may change based on goal priority.

Furthermore, Fishbach, Friedman, and Kruglanski (2003) were interested in how we are able to pursue our goals when those goals conflict with other temptations (e.g., how the goal of losing weight is preserved when presented with cake at a party). They observed that when "wants" (e.g., cake) and "needs" (e.g., weight loss) conflict, the presentation of a "want" will remind someone of their "need", but not the other way around. Moreover, this was found only to be true for those with high self-regulatory success, or ability to achieve goals in general (Fishbach et al., 2003). Again, this study demonstrates that individual differences affect goal-related behaviour in a meaningful way.

Given that goal-achievement and related behaviours vary widely across individuals, it is not surprising that a large portion of the goal literature focuses on these individual differences. Specifically, four behaviours have been highly prevalent within the literature, and will therefore be discussed in more detail below.

Regulatory Focus Theory: Promotion and Prevention

Two goal-related behaviours of interest arise from regulatory focus theory, which posits that goals can be approached with two different focuses (Higgins, 1997). One of these is promotion focus, which is mainly concerned with positive gains related to accomplishments. The

other is prevention focus, which is more concerned with the avoidance of losses related to safety and responsibility (Higgins, 1997). To give a more concrete example, someone who has a goal of doing well on a test the next day may engage in promotion or prevention behaviours. A promotion behaviour might be to review their notes that night; this behaviour directly facilitates doing well on a test and relates to the gain of a high grade. Alternatively, a prevention behaviour would be declining to go out with friends that night; this behaviour may be related to concerns of being too tired to focus when writing the test, meaning that all of the previous work done to do well would have been for nothing.

In order to better evaluate the extent to which individuals engage in promotion-focused and prevention-focused behaviours, Higgins et al. (2001) developed the Regulatory Focus Questionnaire (RFQ), an 11-item self-report scale in which individuals rate the frequency of events and behaviours in their life. The RFQ consists of two subscales measuring promotion-focused and prevention-focused activity, and provides a quantitative way to evaluate how individuals approach goal-directed behaviour. Notably, someone high in promotion focus is not necessarily low in prevention focus; these behaviours are rated along two separate continua, and have been found to be uncorrelated (Higgins et al., 2001).

A fair amount of research has been conducted examining motivational factors related to the promotion and prevention systems. For example, it had previously been demonstrated that due to the focus on gains and non-gains, promotion-focused individuals are mostly concerned about making errors of omission, or errors that involve missing an answer or opportunity (Higgins, 1997; Higgins et al., 2001). Alternatively, prevention-focused individuals are geared to attend to losses and non-losses; as such, they are more concerned with errors of commission, or errors that involve giving the wrong answer or making the wrong decision (Higgins, 1997;

Higgins et al., 2001). Crowe and Higgins (1997) aimed to examine this notion in more detail, proposing that when tasks are made particularly difficult, participants induced to be in a promotion-focused state will be more likely to persevere than those in a prevention-focused state. It was suggested that when in a promotion-focused state, people will be reluctant to give up as doing so would result in an error of omission. Alternatively, prevention-focused individuals will be more attuned to errors of commission, and may find it preferable to not find an answer at all than to give an incorrect answer. Indeed, it was demonstrated that following an impossible anagram task, participants induced to be in a promotion-focused state found more solutions to a difficult anagram than those in a prevention-focused state. Similarly, when confronted with a highly difficult embedded figures task, prevention-focused individuals were more likely to give up than those in a promotion-focused state (Crowe & Higgins, 1997). Furthermore, this notion was more concretely supported in a follow-up study using a recognition memory task. It was observed that when in a promotion-focused state, individuals had a greater bias to classify items in a recognition memory task as "old", demonstrating a reluctance to make an error of omission; that is, they had such a great concern for incorrectly identifying old items that they were willing to make false alarm errors in which new items were also classified as "old". Prevention-focused individuals demonstrated the opposite bias, in which there was a bias to classify items as "new", showing a concern for making errors of commission; that is, they would rather miss identifying old items as "old" if it meant avoiding the mistake of identifying new items as "old" (Crowe & Higgins, 1997).

More generally, many studies have demonstrated that regulatory fit, or how well a presented task aligns with one's regulatory focus, largely drives motivation. That is, if someone is more inclined to a promotion focus, then framing a task in terms of gains and non-gains will

more likely lead to task completion than framing this task in terms of losses and non-losses; the opposite is true for those more inclined to a prevention focus (e.g., Shah, Higgins, & Friedman, 1998). In other words, framing a task in a way that is consistent with a person's current regulatory focus will lead to greater motivation to complete that task.

Interestingly, it has also been demonstrated that responses to successes and failures differ depending on a person's regulatory focus. For example, Higgins, Shah, and Friedman (1997) demonstrated that those with a stronger promotion focus are more likely to demonstrate cheerfulness-dejection responses, and those with a stronger prevention focus are more likely to demonstrate quiescence-agitation responses. This is because promotion-focused individuals are concerned with the presence of positive outcomes (gains), which are likely to lead to cheerful responses, and the absence of positive outcomes (non-gains), which are likely to lead to disappointment. Alternatively, prevention-focused individuals are more attuned to the absence of negative outcomes (non-losses), which lead to quiescence responses, and the presence of negative outcomes (losses), which likely result in increased tension (Higgins et al., 1997). Along the same vein, it has been proposed that when faced with chronic, intense failure, promotion-focused individuals may likely experience depressive symptoms in response to the lack of positive outcomes, whereas prevention-focused individuals may be more likely to have anxious symptoms due to the presence of negative outcomes (Klenk, Strauman, & Higgins, 2011).

Self-Regulatory Modes: Locomotion and Assessment

Along with promotion and prevention, there has been a large literature surrounding behaviours related to two aspects of self-regulation (Kruglanski et al., 2000). More specifically, these behaviours may be thought of as describing strategies used when a goal is to be achieved. One aspect of self-regulation has been defined as assessment, which involves considering

alternatives in order to achieve a goal, and to examine each option from every angle; only once all possibilities have been fully considered can the best option be selected. Locomotion, the other aspect of self-regulation, relates to movement toward a goal, regardless of the path taken (Kruglanski et al., 2000). Again, these behaviours are not thought to be opposites of one another; both are highlighted to be required to some extent for successful goal completion. If the perfect option is picked to achieve a goal, but is never implemented, then goal completion will not occur. Similarly, if an option is implemented without much thought, then the path taken might be a poor one and will unlikely result in goal achievement.

In order to objectively examine how assessment and locomotion impact various aspects of goal-directed behaviour, the Regulatory Mode Questionnaire (RMQ) was developed (Kruglanski et al., 2000). This is a 30-item self-report questionnaire that asks individuals to rate the frequency of various behaviours. Like the RFQ, the RMQ consists of two subscales, each providing a measure of assessment and locomotion. Many studies indicate that locomotion and assessment have a low yet significant positive correlation (e.g., Bornovalova, Fishman, Strong, Kruglanski, & Lejuez, 2008; Hong, Tan, & Chang, 2004; Kruglanski et al., 2000).

Interestingly, many studies have demonstrated that overall, greater goal achievement and higher motivation are positively associated with locomotion behaviours and negatively associated with assessment behaviours. For example, in a study in which participants were induced to be in either a state of locomotion or a state of assessment, those in a state of locomotion were more open to making positive changes in their life (e.g., improving exercise habits, quitting smoking) than those with an assessment focus; this effect was even larger for those more inclined to locomotion behaviours as measured by the RMQ (Scholer & Higgins, 2012). Furthermore, this was found to be still true at a three-week follow-up session. The authors

suggested that high locomotors are more open to change than low locomotors, whereas high assessors are more comfortable with the status-quo than low assessors (Scholer & Higgins, 2012). Related to this finding, it has been demonstrated that even after controlling for the Big Five personality traits of conscientiousness, agreeableness, openness to experience, neuroticism, and extraversion (Goldberg, 1992), locomotion is negatively correlated to procrastination and positively correlated to perseverance, whereas assessment is positively correlated to procrastination (Pierro, Giacomantonio, Pica, Kruglanski, & Higgins, 2011). Other researchers have demonstrated that when locomotion is high compared to low, intentions are more likely to turn into actual behaviour; on the other hand, when assessment is high compared to low, social norms are more likely to influence future behaviour (Kruglanski, Pierro, Mannetti, & Higgins, 2013).

Moreover, it has been observed that assessment behaviours are associated with various psychopathologies, whereas locomotion is associated with lower levels of symptoms. For example, it has been shown that assessment is positively associated with generalized and social anxiety (Kruglanski et al., 2000; Shalev & Sulkowski, 2009), depression (Hong et al., 2004; Kruglanski et al., 2000), stress (Hong et al., 2004), regret (Pierro et al., 2008), borderline personality symptoms (Bornovalova et al., 2008), and impulsivity and obsessive-compulsive symptoms (Shalev & Sulkowski, 2009). Alternatively, locomotion is negatively associated with social anxiety and depression (Kruglanski et al., 2000), regret (Pierro et al., 2008), borderline personality symptoms (Bornovalova et al., 2008), and impulsivity (Bornovalova et al., 2008; Shalev & Sulkowski, 2009). More interestingly, Hong et al. (2004) examined how locomotion and assessment interact to influence levels of depression and life satisfaction. They observed that the greatest levels of depression were reported by high assessors who were also low locomotors.

Alternatively, they found that the highest levels of life satisfaction were reported by high locomotors who were also low assessors. Furthermore, it has been demonstrated that across cultures, predominant locomotors have higher levels of self-esteem, extraversion, agreeableness, openness to experience, and conscientiousness, as well as lower levels of neuroticism than predominant assessors (Higgins, Pierro, & Kruglanski, 2008).

It should be highlighted that although assessment is found to be associated with more negative traits and psychopathology and fewer positive traits than locomotion, it is still viewed as an important aspect of the goal attainment process. For example, Kruglanski et al. (2000) demonstrated that individuals with high levels of both locomotion and assessment were the most likely to later complete an intensive army training course and had higher grade point averages than those with high levels of either locomotion or assessment; similar findings have been shown for effective leadership (Pierro, Giacomantonio, Mannetti, Higgins, & Kruglanski, 2012). Furthermore, it has been shown that groups with a mix of high assessors and high locomotors have overall better task performance than groups of only high assessors or high locomotors (Mauro, Pierro, Mannetti, Higgins, & Kruglanski, 2009).

Grit: Perseverance and Passion for Long-Term Goals

As demonstrated above, it has been proposed that the four described factors related to goal attainment affect a large variety of behaviours, cognitive factors, and personality traits. Interestingly, however, the focus of these studies has been on how these four behaviours affect other measurable individual differences assumed to be outcomes; very little work has been done to examine what factors affect or lead to varying levels promotion, prevention, assessment, and locomotion.

More generally, a fair amount of work has been done examining how personality affects overall success. Personality may be defined as traits that a person expresses consistently across a wide variety of contexts, situations, and people. It is important to note that while personality can be conceptualized in many ways, within the research realm, trait theory is generally adopted as it allows for personality to be more easily quantified and measured than other theories may allow. Most of this work has been done examining how the 5-factor model of personality (the Big Five, consisting of openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism; Goldberg, 1990, 1992), affects academic and career success. For example, studies indicate that the Big Five predicts success above and beyond the predictive power of intelligence and cognitive ability (e.g., Busato, Prins, Elshout, & Hamaker, 2000; Judge, Higgins, Thoresen, & Barrick, 1999; Kuncel, Hezlett, & Ones, 2004; Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007; Seibert & Kraimer, 2001; Ziegler, Danay, Scholmerich, & Buhner, 2010); most consistent across studies is the finding that conscientiousness positively impacts success in a wide variety of domains. Overall, it appears that goal attainment may be highly influenced by various personality traits.

Somewhat separate from the Big Five literature is work examining a newly-described personality trait known as grit. Grit captures passion and perseverance for long-term goals; someone high in grit is likely to have sustained passion for a specific topic (rather than jumping from one interest to the next), and does not easily change goals in the face of obstacles or adversity (Duckworth, Peterson, Matthews, & Kelly, 2007). Grit has generally been measured using either the Grit Scale (Duckworth et al., 2007) or the Short Grit Scale (Grit-S; Duckworth & Quinn, 2009). This trait has been demonstrated to be positively related to self control, as well as

to the Big Five factors of openness, conscientiousness, extraversion, and agreeableness, and negatively related to neuroticism (Duckworth et al., 2007).

Despite these associations, grit has been shown to predict high accomplishment beyond self control and the Big Five in a variety of areas such as time spent studying for (and ultimately greater success in) a national spelling bee, retention in a military training program, and sustained engagement in regular exercise (Duckworth & Quinn, 2009; Reed, Pritschet, & Cutton, 2012). Additionally, lower grit scores are predictive of more time watching television in middle school and high school students, and of more career changes in adults, controlling for age (Duckworth & Quinn, 2009). Overall, it has been observed that higher levels of grit are predictive of greater accomplishment. Though it can be argued that grit may simply reflect intelligence, there are indications that they are separate constructs. For example, in one study, university grade point average was positively associated with grit, whereas SAT scores were actually *negatively* correlated with grit (Duckworth et al., 2007). These findings suggest that early academic success may result in intelligent individuals being less dependent on determination in obtaining success. Furthermore, another study demonstrated that self-control was a better predictor of grade point average than grit, showing that these two constructs are at least somewhat separable (Duckworth et al., 2007).

Although grit is proposed to be a key factor in goal attainment (e.g., Duckworth & Gross, 2014) there has been little focus on connecting grit with previously defined goal-directed behaviours. One study suggests that locomotion and grit are positively associated, whereas assessment and grit are not significantly correlated (Pierro et al., 2011), but overall, research on the effect of grit on the four described goal-related behaviours has been surprisingly lacking. While it seems intuitive to assume that grit is an important factor in goal attainment, it has yet to

be empirically demonstrated how grit affects promotion, prevention, locomotion, and assessment. One of the goals of the present study was to begin to fill this gap in the literature.

Executive Functioning

Success and goal attainment are also greatly affected by cognitive ability, or the higher-order mental processes that allow for complex thought, behaviour, and problem solving. Within this domain, the focus has been on examining how intelligence affects success in academic and professional domains (Fergusson, Horwood, & Ridder, 2005; Gottfredson, 1997; Kuncel, Hezlett, & Ones, 2001; Kuncel et al., 2004; Strenze, 2007). Alternatively, executive functioning (EF) research, a literature within the domain of cognition, has been kept completely estranged from research on success in general and goal-directed behaviour and grit specifically. EF describes separable but related cognitive abilities, such as focusing on important information, maintaining organization, or resisting impulses, and is described as allowing for purposeful, goal-directed behaviour (e.g., Miyake et al., 2000; Toplak, West, & Stanovich, 2013). While many skills are described as falling under the umbrella of EF, such as planning, emotion regulation, and organization, it has been demonstrated that EF can be captured by three core skills: inhibition (withholding an automatic response), working memory (holding information in mind), and mental flexibility (switching attention between various tasks; Miyake et al., 2000). Research has demonstrated that while these three core skills are related, they are indeed separable. Additionally, individual differences in EF are evident across the lifespan, indicating that even when these skills are fully mature, people can greatly differ in their level of executive skill (Huizinga, Dolan, & van der Molen, 2006; McAuley & White, 2011; Miyake et al., 2000).

EF can be evaluated behaviourally through a host of various experimental tasks. The Flanker task, for example, can be used to measure inhibition (Eriksen & Eriksen, 1974). In this

task, participants are shown a central arrow surrounded by flanking arrows on either side. Participants are asked to indicate the direction of the central arrow (left or right) while ignoring the flanking arrows, which are either facing the same direction as the central arrow (compatible trial) or in the other direction (incompatible trial). Inhibition is measured as the difference in response times to incompatible compared to compatible trials, with longer differences in response latencies reflecting poorer inhibition. Working memory may be evaluated with the letter-number sequencing task (Wechsler, 2008), in which participants hear strings of letters and numbers, and must rearrange these strings so that the numbers come first in order, followed by the letters in alphabetical order. These strings increase in length, and working memory is evaluated by how many strings are correctly rearranged. Finally, the plus-minus task may be used to measure mental flexibility (Spector & Biederman, 1976). In this task, participants are presented with three lists of numbers. For the first list, they are to add three to every number; for the second list, they are to subtract three from every number; and for the third list, they are to alternate between adding and subtracting three from the numbers. Participants are timed on how long they are able to complete each list, and mental flexibility is assessed by subtracting the amount of time it took to complete the first two lists from the time it took to complete the third list; smaller differences in time reflect better mental flexibility. These performance-based measures, which are typically conducted in controlled lab environments, are thought to reflect an individual's peak EF in ideal circumstances (Toplak et al., 2013).

On the other hand, EF can also be evaluated with self- and observer-report measures. For example, the Behaviour Rating Inventory of Executive Function (BRIEF; Gioia, Isquith, Guy, & Kenworthy, 2000) is a scale that asks for ratings on an individual's ability to complete everyday tasks requiring EF (e.g., if they are able to focus for extended periods of time; if they are able to

control their emotions). The BRIEF has been validated with children (Gioia, Isquith, Retzlaff, & Espy, 2002), and a different version has been created and validated for use with adults (BRIEF-Adult Version or BRIEF-A; Roth, Isquith, & Gioia, 2005). These questionnaires are thought to reflect how well a person is able to use their EF skills in everyday life, and may also indicate functional difficulties a person is having (Toplak et al., 2013).

Deficits in EF are seen in a wide variety of psychopathologies, such as attention-deficit/hyperactivity disorder (Willcutt, Doyle, Nigg, Faraone, & Pennington, 2005), learning disabilities (Willcutt et al., 2001), and traumatic brain injuries (Levine et al., 1998), to name a few (see Snyder, Miyake, & Hankin, 2015 for a recent review). It is commonly viewed that these deficits in EF invariably lead to difficulties in goal attainment, and in fact, this view has led to a host of rehabilitation programs known as "goal management training" to alleviate these difficulties (e.g., Levine et al., 2000, 2007, 2011).

As mentioned above, EF is defined as cognitive abilities that allow for goal-oriented behaviour. Within this literature, one would be hard-pressed to find a definition of EF that does not highlight the impact it has on purposeful, goal-directed behaviour. Despite this, there is currently no research connecting EF to the expansive literature on specific goal-motivated behaviours. Like the goal of bridging the gap between the literatures on goal attainment and grit, another purpose of the current research program was to begin to investigate the relation between EF and goal attainment as well as EF and grit.

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CHAPTER 2: The Unique Influence of Executive Functioning and Grit on Goal-Oriented Behaviours

Throughout our lives, we are driven by the various goals we hope to achieve. These may be day-to-day goals, such as exercising regularly or eating healthy, or longer-term goals, such as raising a family or obtaining a doctorate degree, both of which may differ between people and change over time. Within social psychology, a large literature has examined various behaviours that allow someone to move closer to a goal, or desired end-state (Gollwitzer, 1990). Regarding goal prioritization, for example, research has demonstrated that when rewards for goal achievement are equated, tasks that are further from completion are prioritized above tasks closer to completion (Schmidt & DeShon, 2007). Other research has focused on goal shielding, an automatic and implicit process that allows us to focus on one goal without getting distracted by another (Shah et al., 2002). For individuals who are well able to stay focused on a goal (what the authors identified as "tenacity"), goal shielding is stronger for higher priority than lower priority goals; this pattern was not observed in those who have difficulty remaining goal-focused, suggesting that tenacity may account for some individual differences in goal shielding (Shah et al., 2002). Other work has demonstrated that when "wants" (e.g., relaxing in front of the television) conflict with "needs" (e.g., going to the gym), being exposed to the "want" will remind people of the "need" but not the other way around. This finding is true only for those who demonstrated good ability in previous goal attainment, again demonstrating individual differences in goal-related behaviours (Fishbach et al., 2003). Not only has there been a fair amount of interest in social psychology and related disciplines on how we work toward goals, but also on how goal-motivated behaviours differ between individuals and the factors that influence these differences.

Individual Differences in Goal-Motivated Behaviour

When studying individual differences in goal-related behaviours, four specific behaviours have been quite influential in particular. Two of these behaviours arise from regulatory focus theory, which proposes that two different foci may be employed in goal motivation (Higgins, 1997): promotion focus, which is related to gains associated with accomplishments, and prevention focus, which is related to the avoidance of losses. For example, someone who is interested in doing well on a midterm may be promotion focused, leading to them studying hard up until the night before the midterm in order to achieve a good grade. Alternatively, a prevention-focused individual may instead choose to avoid staying up late the night before, in order to ensure that they are fully alert when writing the midterm (Higgins, 1997). While these two foci are not mutually exclusive, people tend to have a greater tendency toward one than the other (Higgins et al., 2001). The Regulatory Focus Questionnaire (RFQ) was developed in order to quantitatively measure the levels of promotion focus and prevention focus in individuals, as indicated by two subscale scores; within young adult samples, these scores are not significantly correlated (Higgins et al., 2001).

Numerous studies have demonstrated that the factors that drive promotion-focused individuals differ from those that drive prevention-focused individuals. For example, it has been demonstrated that promotion-focused individuals are more concerned with missing answers or opportunities, whereas prevention-focused individuals are more concerned with making errors (Higgins, 1997; Higgins et al., 2001). Relatedly, promotion-focused individuals are more likely to persevere throughout difficult tasks, as giving up would mean missing answers, whereas prevention-focused individuals are more likely to cease difficult tasks in order to avoid making mistakes (Crowe & Higgins, 1997).

Furthermore, how a task is framed can also influence motivation, with higher levels of motivation when a task is framed in a way that is consistent with a person's regulatory focus (Shah et al., 1998). Promotion-focused individuals tend to be more motivated when gains and non-gains are highlighted; on the other hand, framing a task in terms of losses and non-losses is more effective for those with a prevention focus (Shah et al., 1998). Additionally, regulatory focus has been shown to influence responses to successes and failures (Higgins et al., 1997). The focus on gains and non-gains means that promotion-focused individuals are more likely to demonstrate cheerfulness responses to successes (gains) and disappointment to failures (non-gains). Alternatively, a prevention focus, with its emphasis on losses and non-losses, will likely lead to quiescence responses to successes (non-losses) and tension to failures (losses; Higgins et al., 1997). Similarly, it has been proposed that chronic failure is more likely to lead to depression for promotion-focused individuals and to anxiety for prevention-focused individuals (Klenk et al., 2011). Overall, the work on regulatory focus theory and the RFQ demonstrates that regulatory focus influences perseverance, motivational factors, and emotional responses to success and failures when obtaining goals.

Another two behaviours of interest are related to aspects of self-regulation that influence how individuals approach their goals (Kruglanski et al., 2000). Assessment involves examining all possibilities for goal attainment from every perspective and a focus on choosing the best plan of action. Locomotion describes putting a plan in action to move toward goal attainment, regardless of the plan itself. To more easily evaluate these different tendencies, the Regulatory Mode Questionnaire (RMQ) was developed (Kruglanski et al., 2000). This self-report questionnaire contains two subscales which provide a quantitative measure of locomotion and assessment behaviours. While there are various combinations of high and low assessment and

locomotion, people may have a stronger tendency toward one than the other (Kruglanski et al., 2000). Generally, small positive correlations have been observed between the two (e.g., Bornovalova et al., 2008; Hong et al., 2004; Kruglanski et al., 2000). It has been demonstrated that high levels of both are beneficial when trying to attain goals, whether it be obtaining a high grade point average, completing an intensive military training course, being an effective leader, or when solving a problem (Kruglanski et al., 2000; Mauro et al., 2009; Pierro et al., 2012). Importantly, this indicates that some levels of both assessment and locomotion are necessary for goal attainment but that high levels of one in the absence of the other may be problematic. For example, someone high in assessment and low in locomotion may pick an excellent path for achieving a goal but may have difficulty implementing it. Alternatively, someone high in locomotion may put a plan into action easily, but may have difficulty picking the right plan in the first place if their level of assessment is low.

Interestingly, it has been widely demonstrated that more successful goal achievement and higher motivation are associated with locomotion behaviours than assessment behaviours. For example, those experimentally induced to be in a locomotive state were more open to making positive changes in their lives than those in a state of assessment; this effect was strongest in those who were more naturally inclined to a state of locomotion (Scholer & Higgins, 2012). Additionally, locomotion has been shown to be positively associated to perseverance and negatively correlated to procrastination, whereas assessment is positively correlated to procrastination (Pierro et al., 2011). It has also been suggested that high (versus low) locomotors are more likely to turn intentions into action, whereas high (versus low) assessors are more likely to take action only when it aligns with social norms (Kruglanski et al., 2013).

Lastly, it has been widely demonstrated that high locomotion is associated with more positive outcomes, whereas high assessment is related to psychopathology. Assessment has been observed to be positively correlated with anxiety (Kruglanski et al., 2000; Shalev & Sulkowski, 2009), depression (Hong et al., 2004; Kruglanski et al., 2000), stress (Hong et al., 2004), regret (Pierro et al., 2008), borderline personality symptoms (Bornovalova et al., 2008), and impulsivity and obsessive-compulsive symptoms (Shalev & Sulkowski, 2009), as well as negatively correlated with life satisfaction (Hong et al., 2004). Locomotion, on the other hand, is negatively associated with anxiety and depression (Hong et al., 2004; Kruglanski et al., 2000), regret (Pierro et al., 2008), borderline personality symptoms (Bornovalova et al., 2008) and impulsivity (Bornovalova et al., 2008; Shalev & Sulkowski, 2009), and positively associated with life satisfaction (Hong et al., 2004). Additionally, across cultures, predominant locomotors have higher levels of self-esteem, extraversion, agreeableness, openness, and conscientiousness, and lower neuroticism than predominant assessors (Higgins et al., 2008). Overall, while both locomotion and assessment may be necessary for goal attainment, generally it has been found that locomotion is associated with greater success, motivation, and positive outcomes, whereas assessment is related to lower intrinsic motivation and more psychopathology-related symptoms.

Interestingly, despite the widespread use of both the RFQ and the RMQ, there has been very little research that uses both questionnaires within the same sample. Boldero, Higgins, and Hulbert (2015) reported consistent positive correlations between locomotion and promotion, with no significant correlations between locomotion and prevention, as well as between assessment and both regulatory foci. Additionally, while Appelt, Zou, and Higgins (2010) examined both regulatory focus and regulatory mode, the relationship between the two was not reported. One

goal of the current study was to administer both questionnaires in order to examine the relationships between all four defined behaviours.

Other Factors in Goal Achievement: Grit and Executive Functioning

While the aforementioned studies have well-elucidated how goal-motivated behaviour influences various outcomes, there has been comparatively little focus on factors that influence levels of promotion, prevention, locomotion, and assessment. There are two candidate factors that are discussed below that may likely influence these behaviours, but have yet to be empirically examined as potential influencers of goal-related behaviour.

The first of these factors of interest is grit, which is proposed to be a personality trait influencing passion for and perseverance in obtaining long-term goals, even in the face of difficulty (Duckworth et al., 2007). Grit is typically measured via self-report using either the Grit Scale (Duckworth et al., 2007) or Short Grit Scale (Grit-S; Duckworth & Quinn, 2009). Grit is positively correlated to self-control, openness, agreeableness, extraversion, and conscientiousness, and negatively correlated to neuroticism (Duckworth et al., 2007). However, grit predicts success in a variety of areas above and beyond these constructs, such as in spelling bees, military training programs, and exercise behaviours (Duckworth & Quinn, 2009; Reed et al., 2012), and higher grit is predictive of less time watching television in teenagers and fewer career changes for adults (Duckworth & Quinn, 2009). It has also been demonstrated that grit is not simply a measure of intelligence, with early academic success being negatively associated with grit. Additionally, grade point average has been shown to be better predicted by self-control than by grit, indicating separability between grit and intelligence (Duckworth et al., 2007). Overall, grit has been shown to be a unique construct, reflecting long-term perseverance and is associated with greater success. While one study has shown a positive correlation between

locomotion and grit and a negative correlation between assessment and grit (Pierro et al., 2011), studies examining the impact of grit on goal motivation have been surprisingly lacking.

The second candidate factor of interest for examining influences on goal-related behaviour is executive functioning (EF). EF is an umbrella term which encompasses separable and related cognitive skills such as the focusing of attention to important information, organization, planning, and impulse resistance (Miyake et al., 2000). EF may be evaluated in a variety of ways, such as through behavioural tasks (e.g., Eriksen & Eriksen, 1974; Spector & Biederman, 1976; Wechsler, 2008) or self-report measures (e.g., Gioia et al., 2000, 2002; Roth et al., 2005). Performance on behavioural tasks are thought to reflect peak EF within controlled environments, whereas self-report may reflect how well these EF skills are implemented in real-life circumstances (Toplak et al., 2013). However it is measured, EF is widely described as abilities that allow for goal-directed behaviour (e.g., Miyake et al., 2000; Toplak et al., 2013). Moreover, a fair amount of psychopathologies are associated with poor executive functioning, such as attention-deficit/hyperactivity disorder, learning disabilities, and traumatic brain injuries, among many others (e.g., Levine et al., 1998; Willcutt et al., 2001, 2005; see Snyder et al., 2015 for a review). It is generally thought that these EF deficits lead to difficulties in goal attainment (e.g., Levine et al., 1998; Willcutt et al., 2005), and some researchers have been interested in developing programs to help alleviate these difficulties in goal attainment (e.g., Levine et al., 2000, 2007, 2011).

Despite the centrality of goal-directed behaviour to the definition of EF, there has to our knowledge been no work examining how EF impacts specific goal behaviours, such as promotion, prevention, locomotion, and assessment. Similarly, the relationship between EF and grit has yet to be determined, despite both of these factors described as being integral for goal

attainment. While EF and grit have both been proposed to impact goal motivated behaviour, these constructs appear to be quite different. On the one hand, grit is a personality trait involving perseverance and passion for long-term goals. Alternatively, EF involves a variety of separable cognitive skills that allow for the focus of attention toward relevant information, organization, and behaviour regulation. These skills are proposed to aid in goal-oriented behaviour, whether that be the simple goal of getting dressed in the morning or the long-term goal of advancing one's career. Clearly, while grit and EF may theoretically impact similar outcomes, they are describing very different abilities. It is likely that both are important for successful goal-motivated behaviour, with EF affording one the skills necessary for goal attainment and high grit allowing for perseverance in the face of difficulty.

It is important to note that the current investigation is being conducted under the assumption that EF and grit (a personality trait) impact goal-directed behaviour, and not the other way around. While it can certainly be argued that goal-directed behaviour may affect EF and grit, there are a few key factors that indicate that EF and personality are more likely than goal-motivated behaviour to be causal factors. First, both EF and personality have been observed to emerge early on, with evidence of EF skills within the first year of development (Garon, Bryson, & Smith, 2008) and markers of personality apparent by age three (Caspi & Roberts, 2001; Caspi & Silva, 1995); both are evident before sophisticated goal motivated behaviours are likely to be present. Furthermore, individual differences in EF (Friedman et al., 2009) and personality (Caspi & Roberts, 2001; McGue, Bacon, & Lykken, 1993) have been demonstrated to have a strong genetic basis, indicating that they are impacted by factors that precede goal-directed behaviour. Finally, it has been shown that individual differences in EF (Friedman et al., 2016) and personality (see Caspi & Roberts, 2001) remain stable across development, suggesting that these

factors are unlikely to be significantly changed by how individuals approach their goals. These points led us to approach the present study with the view that EF and grit would affect promotion, prevention, locomotion, and assessment, rather than these behaviours impacting EF and grit; the latter possibility is addressed further on in the General Discussion.

The Present Study

The purpose of the present research was to better understand how grit and EF impact levels of promotion, prevention, locomotion, and assessment. Specifically, we were interested in answering three questions. First, we examined to what extent goal-motivated behaviours are or are not related. It was predicted that locomotion, promotion, and prevention would be positively inter-correlated, as they all describe behaviours directly related to goal achievement, and that each would be unrelated to assessment, since assessment behaviours are those that involve thinking through a plan for goal achievement as opposed to enacting a plan. Second, we wanted to explore whether or not grit and EF are separable constructs. While EF and grit were expected to be positively correlated, it was also expected that they would not reflect the same underlying construct, as the former reflects cognitive skills and the latter reflects hardiness in the face of difficulty. Finally, we were most interested in examining to what extent goal-motivated behaviours are influenced by grit and EF. It was expected that higher levels of grit and better EF would both make unique contributions to explaining goal-motivated behaviours.

Study 1

In order to answer the aforementioned questions, an online study was conducted which asked participants to fill out self-report questionnaires evaluating prevention, promotion, locomotion, assessment, grit, and EF. The data were analyzed with the intent of examining the shared and unique contributions of grit and EF on levels of goal-directed behaviour. It was

hypothesized that higher levels of grit would positively predict promotion and locomotion, as grit and locomotion have previously been shown to be positively correlated (Pierro et al., 2011) and promotion describes behaviours related to obtaining gains. Furthermore, work by Crowe and Higgins (1997) demonstrates that individuals induced to be in a promotion-focused state are less likely to give up on solving difficult problems—a notion similar to what is described by grit. Alternatively, EF was predicted to have a greater influence on levels of prevention, as these are behaviours that involve refraining from acting to avoid losses, and may require greater executive control. EF was also hypothesized to predict levels of assessment, as these tend to be planning behaviours, which are also dependent on executive control.

Methods

Participants. Ninety-eight students from the University of Waterloo completed the online study through Qualtrics in exchange for course credit. Three participants were removed from the sample for not completing the full set of questionnaires. One participant was removed from the sample for declining to answer over 50% of the questions on three out of four questionnaires. The final sample included data from 94 participants (62% female, mean age = 22, 45% Asian, 21% Caucasian, 17% South Asian, 16% other).

Measures. The questionnaires used were presented in a fix order across participants, as we were interested in examining individual differences; these measures are described below in that same order. For all measures, participants were given an additional response option of "prefer not to say"; if a participant indicated this option on over 10% of the items on a questionnaire, their score for that questionnaire was removed. If a participant declined to answer less than 10% of items on a questionnaire, the score for a specific missing item was calculated by averaging the response to that question across participants. The exception to this rule was the

BRIEF, which contains its own validity scales and is able to accommodate a certain number of missing items when being scored.

Demographic questionnaire. This questionnaire was designed for the current study in order to obtain participants' age, gender, ethnicity, the year they started their undergraduate degree, and their program of study.

Regulatory Focus Questionnaire (RFQ; Higgins et al., 2001). The RFQ is an 11-item measure that requires participants to rate the frequency of events on a scale from 1 (never or seldom) to 5 (very often). This questionnaire consists of two subscales which indicate participants' levels of promotion focus (6 items) and prevention focus (5 items) when it comes to goal motivated activity. Scores on both subscales are calculated by taking an average of the scores from the relevant questions, and range from 1 to 5; higher scores indicate higher levels of that particular focus. Within the current sample, the mean promotion score was 3.29 (SD = 0.60) and the mean prevention score was 3.36 (SD = 0.89). The promotion subscale contains items such as, "Compared to most people, are you typically unable to get what you want out of life?" and, "I feel like I have made progress toward being successful in my life." Alternatively, the prevention subscale contains statements such as, "Not being careful enough has gotten me into trouble at times," and, "How often did you obey rules and regulations that were established by your parents?" Higgins et al. (2001) demonstrated good internal consistency for both the promotion (α = .73) and prevention subscales (α = .80). In the current sample, the prevention subscale showed good internal consistency (α = .85), whereas the internal consistency for the promotion subscale was lower (α = .64). RFQ scores from all 94 participants were included in the final analysis.

Behavior Rating Scale of Executive Function—Adult Version (BRIEF-A; Roth et al., 2005). The BRIEF-A is a 75-item questionnaire that asks participants to rate the frequency of behaviours on a scale of 1 (never) to 3 (often). This scale provides an overall Global Executive Composite (GEC) by adding up the responses provided, which ranges from 70 to 210; higher scores indicate greater levels of executive dysfunction. Scores from the current sample had a mean of 118.44 (*SD* = 23.69). The BRIEF-A contains items such as, "I have angry outbursts," and, "I tap my fingers or bounce my legs." Roth et al. (2005) indicated excellent internal consistency of the BRIEF-A (α ranging from .93 to .96). The internal consistency in the current sample was also excellent (α = .96). The BRIEF-A includes validity scales that detect a bias toward giving highly negative answers and inconsistency in responding, and also indicate when too many questions were unanswered for proper scoring. These validity scales indicated that six participants in the sample produced unusable BRIEF-A scores; as such, 88 scores from the BRIEF-A were included in the final analysis.

Short Grit Scale (Grit-S; Duckworth & Quinn, 2009). The Grit-S is an 8-item scale that requires participants to rate statements about themselves on a scale of 1 (very much like me) to 5 (not at all like me). This scale provides a grit score by averaging the responses to the 8 questions, and ranges from 1 to 5; higher scores reflect higher levels of grit. The current sample had an average grit score of 3.12 (*SD* = 0.57). Sample items from the grit scale are, "New ideas and projects sometimes distract me from previous ones," and, "Setbacks don't discourage me." Duckworth and Quinn (2009) demonstrated good internal consistency for the Grit-S (α = .83 in an undergraduate sample). In the current sample, the internal consistency was acceptable (α = .73). Data from two individuals on the Grit-S were removed from the data set as over 10% of the questions were not answered, leaving 92 scores for the final analysis.

Response Mode Questionnaire (RMQ; Kruglanski et al., 2000). The RMQ is a 30-item questionnaire that requires participants to rate statements about themselves on a scale of 1 (strongly disagree) to 6 (strongly agree). The RMQ consists of two subscales describing different behaviours when pursuing goals: the assessment subscale and the locomotion subscale (12 items each). Scores on both subscales are calculated by taking an average of the responses provided and range from 1 to 6, with higher scores indicating higher levels of that behaviour. Within the current sample, the mean assessment score was 4.01 (SD = 0.77) and the mean locomotion score was 4.05 (SD = 0.69). The assessment subscale contains items such as, "I like evaluating other people's plans," and, "I often compare myself with other people." Sample items from the locomotion subscale are, "I am a 'do-er'," and, "When I finish one project, I often wait awhile before getting started on a new one." Kruglanski et al. (2000) demonstrated good internal consistency for both the locomotion (α ranging from .78 to .85 across 11 undergraduate samples) and assessment subscales (α ranging from .75 to .80 across 11 undergraduate samples). In the current sample, both of the subscales demonstrated good internal consistency (α = .80 for locomotion and .81 for assessment). One participant declined to answer over 10% of the questions in the RMQ, leaving 93 scores available for final analysis.

Previous diagnoses. The final question in the study asked participants if they had been previously diagnosed with any neuropsychological disorders by either a medical doctor or psychologist. The options for this question were Attention-Deficit/Hyperactivity Disorder (ADHD); Learning Disability (LD); Autism Spectrum Disorder (ASD; including Asperger's Syndrome); Traumatic Brain Injury (TBI); none of the above; and prefer not to say. In the current sample, 2.1% had been diagnosed with ADHD, 3.2% had been diagnosed with a LD, 0% had been diagnosed with an ASD, and 5.3% had suffered from a TBI. As less than 10% of

participants identified as having neuropsychological difficulties, this factor was not included in our final analysis.

Results

Two outliers were identified by examining the studentized residuals of each predictor variable on each dependent variable in the regression model (see below); any studentized residual above 3 or below -3 was considered an outlier. An analysis of Cook's D indicated that the outliers were not influential on the analysis (all Cook's Ds < 0.30); therefore no participants were removed prior to analysis. The predictor variables (grit and GEC) were mean centred for the regression analyses. Finally, in the cases that whole scores were missing due to a participant declining to answer over 10% of items on a questionnaire, missing values were calculated using the expectation maximization method.

Correlations. Analyses were first conducted in order to examine the correlations between the six variables of interest: promotion, prevention, assessment, locomotion, grit, and the GEC (see Table 1). Consistent with the literature, promotion and prevention were not significantly correlated (Higgins et al., 2001), and assessment and locomotion were positively correlated (Kruglanski et al., 2000). Additionally, and consistent with Boldero et al. (2015), it was found that promotion and locomotion, both describing behaviours that allow for movement toward a goal, were positively correlated. Finally, assessment was *negatively* correlated with both promotion and prevention behaviours; that is, participants who reported in engaging in more evaluative thinking also reported fewer behaviours related to goal achievement.

Table 1
Correlation Table for Study 1

	Promotion	Prevention	Assessment	Locomotion	Grit	GEC
Promotion	--					
Prevention	.137	--				
Assessment	-.206*	-.334**	--			
Locomotion	.517***	.052	.206*	--		
Grit	.523***	.283**	-.255*	.497***	--	
GEC	-.390***	-.418***	.310**	-.341**	-.594***	--

*Note: *p < .05; **p < .01; ***p < .001*

More important to the current investigation were the correlations involving grit and the GEC. It was observed that measures of these two constructs were highly negatively correlated, reflecting that those reporting higher grit also tend to report lower GEC (which is a measure of executive dysfunction); in other words, better EF is associated with more grittiness. Additionally, both higher grit and better EF were associated with greater promotion, prevention, and locomotion behaviours, whereas higher grit and better EF were associated with fewer assessment behaviours.

Regression Analyses. In order to determine the individual and joint impact of grit and EF on goal-motivated behaviours, a regression model was conducted using AMOS Graphics software. In this model, grit, GEC, and the interaction term between the two were specified to be predictors of all four goal-motivated behaviours being examined. Additionally, covariances were included between all of the predictor variables, as well as between the error terms of the goal-motivated behaviours. All terms that were not significant in the full model were dropped, producing the regression model in Figure 1.

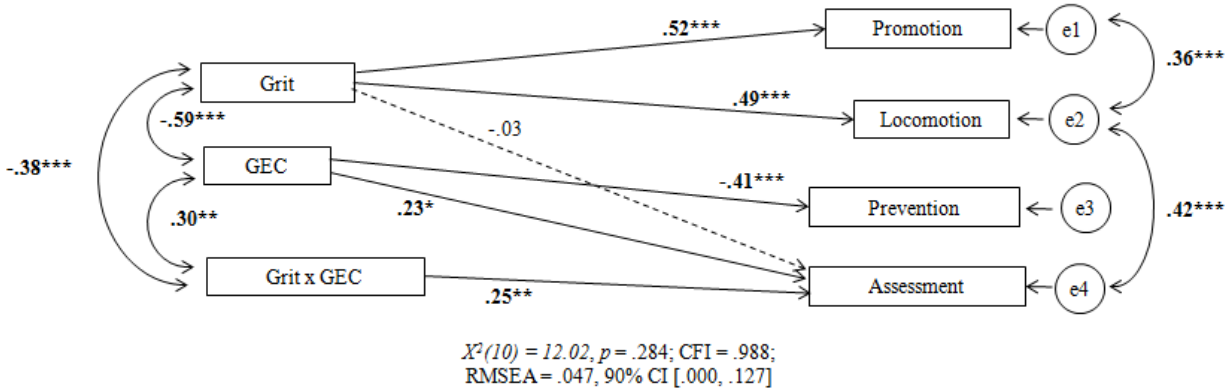

Figure 1 Regression model for Study 1. Note that all numbers here and in all other figures are in standardized form.
**p < .05; **p < .01; ***p < .001*

All covariances between the predictor terms (grit, GEC, and the interaction term) were significant. Additionally, it was revealed that there was error covariance between the locomotion and promotion subscales, as well as the locomotion and assessment subscales. The error covariance between the locomotion and promotion subscales may be due to the two behaviours both leading to goal enhancement, or movement toward a goal. On the other hand, error covariance between locomotion and assessment is likely due to them being measured by the same questionnaire.

The regression model indicated that grit independently predicted promotion, $\beta = .52$, $p < .001$, and locomotion, $\beta = .49$, $p < .001$, indicating higher levels of grit were predictive higher promotion focus and higher locomotion. Furthermore, GEC independently predicted prevention behaviours, $\beta = -.41$, $p < .001$, with better EF predicting higher prevention focus**.**

Assessment behaviours were also predicted by EF, $\beta = .23$, $p = .027$, with more assessment behaviours predicted by poorer EF (or higher GEC values). More interesting, though, was the joint impact of grit and EF on assessment behaviours, $\beta = .25$, $p = .008$. Simple slopes were tested to better understand the relation between EF and assessment behaviours for low grit

(1 standard deviation below the mean), moderate grit (mean), and high grit (1 standard deviation above the mean; see Figure 2). The simple slope for high levels of grit was significant, indicating a positive association between GEC and assessment behaviours, $t = 3.48$, $p < .001$; that is, in those reporting high levels of grit, poorer EF was predictive of more evaluative thinking and related behaviours than those with good EF. The simple slope analyses were not significant for low and moderate levels of grit, both p's > .10.

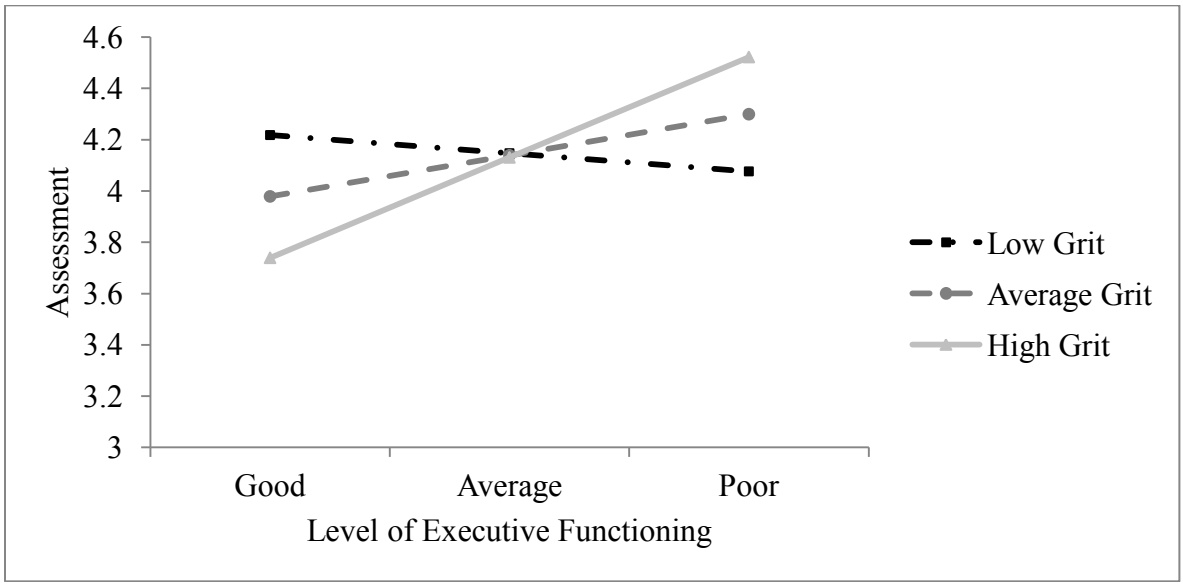

Figure 2 Simple slopes to examine the interaction between grit and EF on assessment in Study 1.

Discussion

Overall, Study 1 demonstrated that while EF and grit are highly related constructs, they appear to affect a variety of goal-motivated behaviours in different ways. Specifically, it was observed that higher levels of self-reported grit were predictive of more frequent promotion and locomotion behaviours. Additionally, locomotion and promotion were highly related; this is not surprising, as both describe taking actions to move toward goal attainment. Alternatively, prevention, which describes behaviours that indirectly lead toward a goal by avoiding non-

helpful actions, was predicted by higher levels of EF. It seems that grittiness may be more involved with goal-motivated behaviours that lead to goal enhancement, whereas EF may allow for the avoidance of behaviours that impede goal achievement.

Assessment behaviours were also predicted by EF, though more interesting was the interaction between grit and EF on assessment behaviours. It was observed that for those with high levels of grit, poorer EF was predictive of more assessment behaviours. It may be the case that for those with high levels of grit but poor EF, individuals tend to spend too much time in the evaluative thinking stage of goal attainment, and are unable to choose a plan and stick to it due to their lower levels of EF. In other words, they want to see their goals through (as driven by high levels of grit) but are unsure how to go about doing so (due to lower levels of EF). However, it is important to note that this finding is not replicated in Study 2, and as such, may not be wholly worthwhile to interpret.

The findings from Study 1 provide much-needed insight into how different goal-motivated behaviours are driven by perseverance and cognitive abilities. However, this initial study does not indicate how these abilities and behaviours may affect various real-world outcomes. The purpose of Study 2 was to extend the findings from Study 1 by examining other personality measures, mood difficulties, and academic outcomes.

Study 2

The purpose of Study 2 was to expand the regression model from Study 1 by examining outcome measures, as well as other predictive factors. First, we were interested in examining how differing levels of each goal-related behaviour influence grade point average (GPA), because within a university sample obtaining a high GPA is a common goal across individuals. Specifically, participants were asked both for current cumulative GPA as well as their GPA from

their first year of university. This was done as individuals widely differ in how they handle the transition period from high school to post-secondary school, and the influences on high GPA in first year university may differ from factors influencing GPA later on. By asking participants to provide both their first year and their cumulative GPAs, this notion could be better evaluated. Additionally, in line with previous findings (e.g., Hong et al., 2004; Kruglanski et al., 2000; Shalev & Sulkowski, 2009), levels of depression, anxiety, and stress were measured in order to determine how various self-regulatory behaviours may mediate the effect of grit and EF on these psychopathologies.

Finally, neuroticism was measured in order to include it as a third predictive factor, along with grit and EF. As previously mentioned, neuroticism is positively associated with levels of assessment (Higgins et al., 2008) and negatively associated with grit (Duckworth et al., 2007); the relationship between neuroticism and EF is less clear, though there is some evidence of a negative correlation between EF and neuroticism (Robinson & Clore, 2007; Robinson, 2007). As such, including neuroticism as another predictive measure may help to explain the interaction of grit and EF on assessment observed in Study 1, and may better elucidate the factors that influence various goal-related behaviours.

Methods

Participants. For Study 2, 147 students from the University of Waterloo completed the online study through Qualtrics in exchange for course credit. One participant was removed from the sample for not completing the set of questionnaires. Three participants were removed from the sample for not answering over 10% of the items on at least three out of seven questionnaires. The final sample included data from 143 participants (73% female, mean age = 21; 40% Asian, 17% Caucasian, 26% South Asian, 17% other).

Measures. The study was identical to Study 1 with the following exceptions. An additional question was added to the background questionnaire asking participants to indicate their faculty within the university. Additionally, four other measures were added to the questionnaire between the RMQ and the question about previous diagnoses, which are described below in order, along with descriptive statistics for all questionnaires for the current sample.

RFQ (Higgins et al., 2001). Within the current sample, the mean promotion score was 3.36 (*SD* = 0.68) and the mean prevention score was 3.48 (*SD* = 0.87). Furthermore, the prevention subscale showed good internal consistency (α = .82), and the internal consistency for the promotion subscale was acceptable (α = .73). Four participants declined to answer over 10% of the RFQ questions; therefore scores from 139 participants were included in the final analysis.

BRIEF-A (Roth et al., 2005). Scores from the current sample had a mean of 100.30 (*SD* = 34.14). The internal consistency in the current sample was excellent (α = .97). The BRIEF-A validity scales indicated that six participants in the sample produced unusable BRIEF-A scores; as such, 137 scores from the BRIEF-A were included in the final analysis.

Grit-S (Duckworth & Quinn, 2009). The current sample had an average grit score of 3.24 (*SD* = 0.63). The internal consistency for the current sample was acceptable (α = .78). Scores from all participants were included in the final analysis.

RMQ (Kruglanski et al., 2000). Within the current sample, the mean assessment score was 4.08 (*SD* = 0.73) and the mean locomotion score was 4.11 (*SD* = 0.75). Both of the subscales demonstrated good internal consistency (α = .85 for locomotion and .81 for assessment). Two participants declined to answer over 10% of the questions in the RMQ, leaving 141 scores available for final analysis.

Emotional stability scale (IPIP, n.d.-b). The emotional stability scale is a 10-item International Personality Item Pool (IPIP) representation of the Goldberg (1992) markers for the Big Five personality structure, and reflects the opposite construct of neuroticism (IPIP, n.d.-b). This questionnaire requires participants to rate statements about themselves on a scale of 1 (very inaccurate) to 5 (very accurate). Scores range from 10 to 50, with higher scores indicating higher levels of emotional stability. The current sample had a mean score of 29.42 (*SD* = 8.69). The emotional stability scale has items such as, "Am relaxed most of the time," and, "Worry about things." Good internal consistency was reported for this scale (α = .86; IPIP, n.d.-b), and good internal consistency was demonstrated in the current sample (α = .88). Scores from all participants were included in the final analysis.

Depression, Anxiety, and Stress Scale (DASS 21; Antony, Bieling, Cox, Enns, & Swinson, 1998). The DASS 21 is a 21-item questionnaire which requires participants to rate statements about themselves on a scale of 0 (never) to 3 (almost always), such that higher scores indicate higher levels of the symptom of interest. The DASS 21 consists of three subscales: a depression subscale (range = 0-42), an anxiety subscale (range = 0-42), and a stress subscale (range = 0-42). The current sample had a mean depression score of 11.62 (*SD* = 10.50), a mean anxiety score of 11.96 (*SD* = 9.78), and a mean stress score of 13.08 (*SD* = 9.17). Sample items include, "I felt that I had nothing to look forward to," "I was worried about situations in which I might panic and make a fool of myself," and, "I found it hard to wind down," from the depression, anxiety, and stress subscales, respectively. Antony et al. (1998) reported good internal consistency for the anxiety subscale (α = .87) and excellent internal consistency for the depression (α =.94) and stress (α = .91) subscales. In the current sample, the anxiety and stress subscales demonstrated good internal consistency (α = .86 for both subscales) and the depression

subscale demonstrated excellent internal consistency (α = .92). Two participants did not answer over 10% of items; therefore scores from 141 participants are included in the final analysis.

Neuroticism scale (IPIP, n.d.-a). The Neuroticism scale is a 10-item IPIP representation of the Costa & McCrae (1992) NEO personality factor structure, and is very similar to the Emotional Stability scale described above. It is also a 10-item questionnaire rated on a scale of 1 (very inaccurate) to 5 (very accurate). Scores range from 10 to 50, with higher scores indicating higher levels of neuroticism. The mean score in the current sample was 27.58 (*SD* = 8.33). Items from this scale include, "Rarely get irritated," and, "Dislike myself." Good internal consistency was reported for the Neuroticism scale (α = .86; IPIP, n.d.-a). In the current sample, equivalent internal consistency was evident (α = .86). Two participants did not answer over 10% of the questions; therefore 141 scores are included in the final analysis.

Grade point average (GPA). This portion of the questionnaire was designed for the current study to obtain participants' GPAs. Participants were instructed to sign in to their student portal in order to access grade values directly from their transcript, indicating both their average after their first year of their undergraduate degree, as well as their current cumulative average. They were also asked to indicate on a 7-point Likert scale how important grades were to themselves and how important grades were to their families, with 1 being least important and 7 being most important.

***Previous diagnoses*.** In the current sample, 2.1% had been diagnosed with ADHD, 2.1% had been diagnosed with a LD, 0% had been diagnosed with an ASD, and 4.9% had suffered from a TBI. Again, as less than 10% of participants identified as having neuropsychological difficulties, this factor was not included in our final analysis.

Results

Three outliers were identified by examining the studentized residuals of each predictor variable on each dependent variable in the regression models (see below); any studentized residual above 3 or below -3 was considered an outlier. An analysis of Cook's D indicated that none of the outliers were influential on the analysis (all Cook's Ds < 0.60); therefore no participants were removed prior to analysis.

As two different scales were used to evaluate neuroticism (the neuroticism scale and the emotional stability scale), they were combined into one single neuroticism score. This was done by subtracting each participant's emotional stability score from 50 (the highest possible score) and adding it to their neuroticism score. The predictor variables (grit, GEC, and neuroticism) were mean centred for the regression analyses. Finally, missing values were again imputed using the expectation maximization method.

Correlations. Consistent with Study 1, the correlations were examined between all variables of interest (promotion, prevention, assessment, locomotion, grit, GEC, neuroticism, stress, anxiety, depression, first year average, and cumulative average; see Table 2).

Table 2

Correlation Table for Study 2

	Promotion	Prevention	Assessment	Locomotion	Grit	GEC	Neuroticism	Depression	Anxiety	Stress	First Year GPA	Cumulative GPA
Promotion	--											
Prevention	.198*	--										
Assessment	-.111	-.020	--									
Locomotion	.641***	.055	.023	--								
Grit	.538***	.211*	-.072	.612***	--							
GEC	-.533***	-.292***	.079	-.412***	-.524***	--						
Neuroticism	-.534***	-.331***	.360***	-.281***	-.409***	.435***	--					
Depression	-.554***	-.306***	.196*	-.442***	-.453***	.504***	.724***	--				
Anxiety	-.426***	-.313***	.274**	-.220**	-.322***	.387***	.631***	.736***	--			
Stress	-.399***	-.384***	.297***	-.104	-.245***	.425***	.721***	.714***	.798***	--		
First Year GPA	.195*	-.094	.109	.179*	.203*	.008	-.143†	-.119	-.070	.018	--	
Cumulative GPA	.228**	-.088	.018	.211*	.207*	-.020	-.160†	-.145†	-.080	.009	.895***	--

*Note: $^{\dagger}p < .10$; *$p < .05$; **$p < .01$; ***$p < .001$*

Of primary interest were the correlations among the four goal behaviours, GEC, and grit, in order to determine if the results from Study 1 were replicated. First, it should be noted that, as in Study 1, promotion and locomotion were positively correlated. Promotion was also positively correlated with prevention, which was not the case in the first sample. More important, however, was that again, promotion, prevention, and locomotion were all associated with better EF and higher grit, and that GEC (which indicates executive dysfunction) and grit were negatively correlated (thus, higher grit is associated with better EF). Interestingly, assessment was not significantly correlated with any of the other goal behaviours, nor was it correlated with grit or the GEC.

Next, we were interested in examining the relation between the third predictor variable, neuroticism, and the other examined variables. Consistent with the literature, neuroticism was negatively correlated with locomotion and grit (Duckworth et al., 2007; Kruglanski et al., 2000); it was also negatively correlated with promotion, prevention, EF, and cumulative GPA. Neuroticism was positively correlated to assessment, consistent with previous reports (Kruglanski et al., 2000), and was also positively correlated with stress, depression, and anxiety.

Finally, we were interested in examining the correlations with the outcome measures of interest: stress, anxiety, depression, and GPA. Locomotion, promotion, prevention, EF, and grit were all negatively correlated with depression, anxiety, and stress, whereas neuroticism and assessment were positively correlated with these outcome measures. GPAs (both first year and cumulative) were positively correlated with promotion, grit, and locomotion, whereas neuroticism was negatively correlated with cumulative GPA. GPA was not significantly correlated with GEC, prevention, and assessment.

To summarize, these correlations indicate that better EF, higher grit, and more promotion, prevention, and locomotion behaviours are associated with better outcome measures (i.e., lower levels of stress, anxiety, and depression, as well as higher GPA), whereas neuroticism and assessment are associated with worse outcomes. More interesting were the negligible correlations between assessment and grit, GEC, and the three other goal behaviours, indicating a possibly tenuous association between assessment and goal-motivated behaviours.

Regression Analyses. Similar to Study 1, all regression analyses were conducted using AMOS Graphics software.

Study 1 Replication. We were first interested in determining if the model from Study 1 would be replicated in the new sample. In order to do this, a regression model was conducted in which grit, GEC, and the interaction term between the two were specified to be predictors of all four goal-motivated behaviours being examined, with covariances between all of the predictor variables and the error terms of the goal-motivated behaviours. As in Study 1, all terms that were not significant in the full model were dropped. The final model is displayed in Figure 3.

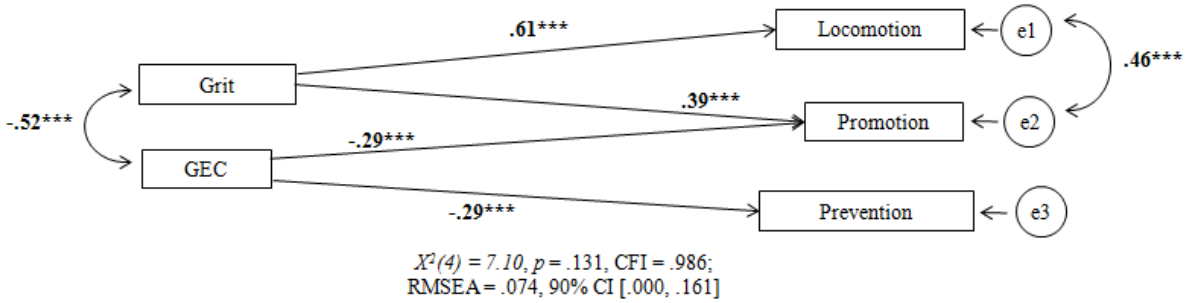

Figure 3 Replication of regression model for Study 2.
**p < .05; **p < .01; ***p < .001*

Most notably, the interaction term and the measure of assessment were dropped from this model. The interaction term no longer predicted assessment, nor did GEC or grit. Additionally,

none of the error covariances between assessment and the other goal measures were significant, leaving a final model with only three of the goal-related behaviours of interest. Despite this large deviation from the model in Study 1, the rest of the previous findings were replicated: grit predicted greater levels of locomotion, $\beta = .61$, $p < .001$, and promotion, $\beta = .39$, $p < .001$; and lower GEC (and thus better EF) predicted greater levels of prevention, $\beta = -.29$, $p < .001$. Finally, in this sample, lower GEC also predicted greater levels of promotion, $\beta = -.29$, $p < .001$.

Basic Model Extension. Another goal of Study 2 was to expand the model to include another predictor variable, neuroticism. In order to do this, a regression model was conducted in which grit, GEC, neuroticism, and all possible two-way interactions were specified to be predictors of all four goal-motivated behaviours being examined. Covariances were included between all of the predictor variables and the error terms of the goal-motivated behaviours. As in Study 1, all terms that were not significant in the full model were dropped. The final model is displayed in Figure 4.

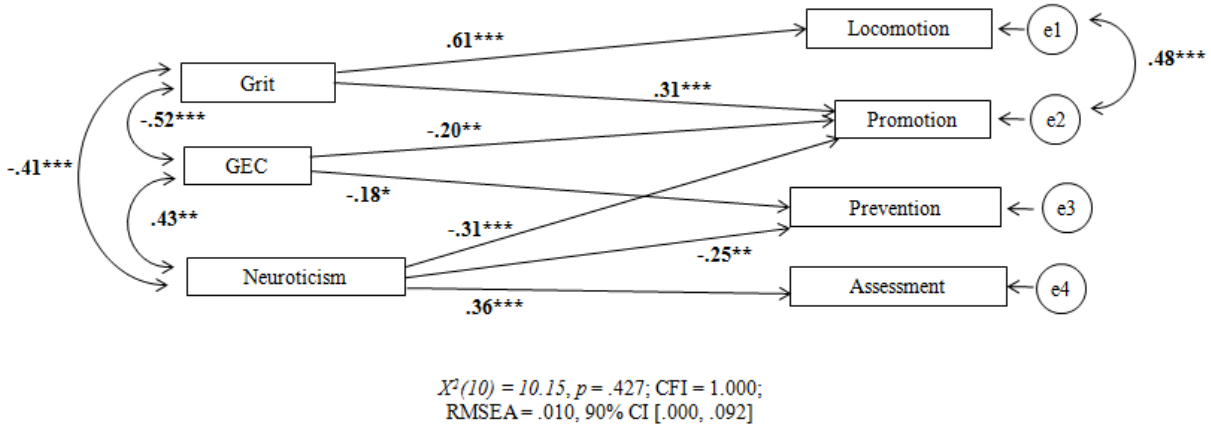

Figure 4 Basic extension of regression model for Study 2.
**p < .05; **p < .01; ***p < .001*

In addition to the findings from the previous model (Figure 3), this regression model indicated that neuroticism predicts assessment behaviour, $\beta = .36$, $p < .001$, with higher neuroticism leading to more assessment. Furthermore, neuroticism predicts promotion and

prevention in the opposite direction: higher neuroticism leads to fewer promotion and prevention behaviours, $\beta = -.31$, $p < .001$ and $\beta = -.25$, $p = .004$, respectively.

Outcome Measures: Affect. Another goal of Study 2 was to expand the model to include four outcome measures (depression, anxiety, stress, and GPA). For simplicity, the outcome measures of affect (i.e., depression, anxiety, and stress) were examined separately from GPA.

To build the expanded model, we began with the model from the basic extension (see Figure 4). From there, the three predictor variables and four goal behaviours were all indicated to predict depression, stress, and anxiety; covariances were included between the measures of affect as they came from the same scale.

Since we were interested in examining both the direct and indirect effects of the predictor variables on the outcome variables, not all non-significant terms were dropped from this model. Only non-significant direct paths from the predictors to the outcomes were removed; all paths from the goal behaviours to the outcomes remained in the model. The final model can be seen in Figure 5; note that beta values and covariances are not shown in the model to allow for more visual simplicity. Beta values are instead displayed separately in Table 3 (beta values from Figure 4 are not displayed, as they remained the same in this model).

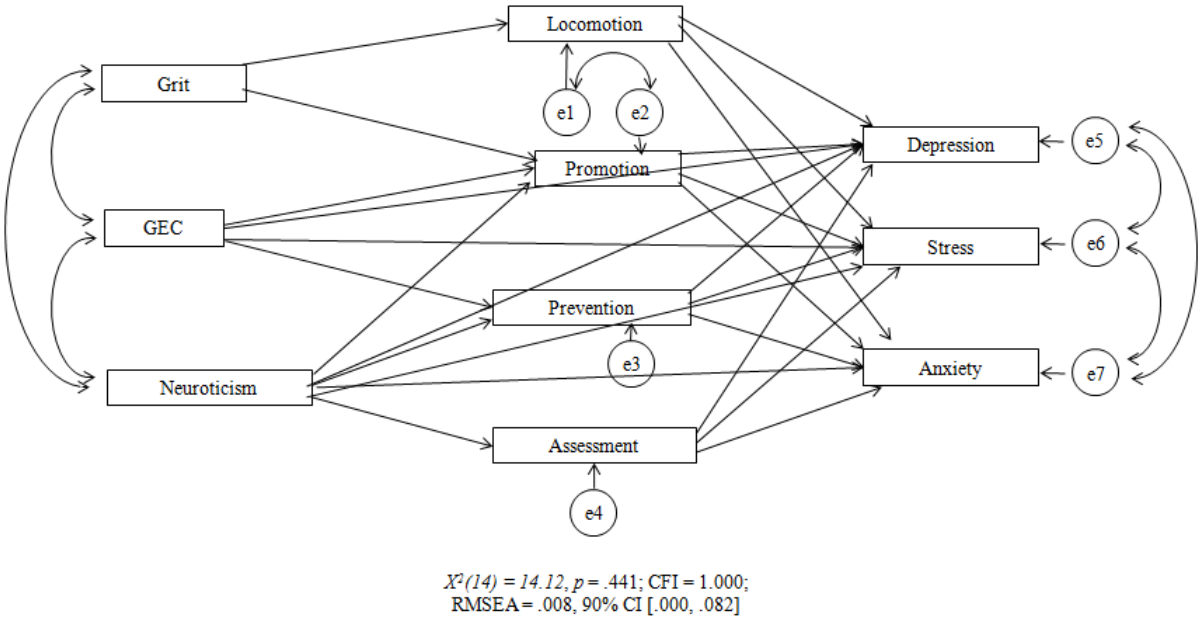

Figure 5 Regression model for Study 2 indicating affect outcome variables.
**p < .05; **p < .01; ***p < .001*

Table 3
Beta Weights and Significance Values for Figure 5

Predictor	Outcome	Beta Weight	Significance
GEC	**Depression**	**.10**	**.076**
GEC	**Stress**	**.10**	**.047**
Neuroticism	**Depression**	**.59**	**< .001**
Neuroticism	**Stress**	**.61**	**< .001**
Neuroticism	**Anxiety**	**.49**	**< .001**
Locomotion	**Depression**	**-.20**	**.003**
Locomotion	**Stress**	**.18**	**.010**
Locomotion	Anxiety	.01	.880
Promotion	Depression	-.05	.516
Promotion	Stress	-.10	.214
Promotion	Anxiety	-.14	.144
Prevention	Depression	-.06	.260
Prevention	**Stress**	**-.14**	**.015**
Prevention	**Anxiety**	**-.12**	**.071**
Assessment	Depression	-.03	.651
Assessment	Stress	.05	.381
Assessment	Anxiety	.08	.252

Note: Rows are in bold to highlight significant values.

It was observed that there was a marginal direct effect of GEC on depression, $\beta = .10$, $p = .076$, and a significant effect of GEC on stress, $\beta = .10$, $p = .047$; in both cases, worse EF

predicted higher levels of negative affect. Unsurprisingly, there were also positive directs effects of neuroticism on depression, $\beta = .59$, stress, $\beta = .61$, and anxiety, $\beta = .49$, all p's $< .001$. Finally, none of the direct effects of grit on any of the outcomes were significant, all p's $> .10$.

Both locomotion and prevention had a direct impact on the outcome measures, as well. Locomotion had a direct effect on depression, $\beta = -.20$, $p = .003$, and stress, $\beta = .18$, $p = .010$, with higher locomotion predicting lower depression, but higher levels of stress. The effects of prevention were more straightforward, with higher prevention predicting lower stress, $\beta = -.14$, $p = .015$, and marginally predicting lower levels of anxiety, $\beta = -.12$, $p = .071$. All other direct effects of the goal behaviours on the measures of affect were not significant, all p's $> .10$.

Next, we examined indirect effects of the predictor variables (i.e., GEC, grit, and neuroticism) on the outcome measures. In order to examine these effects, bootstrapping was used with 2000 bootstrapped samples specified. There were significant indirect effects of grit on stress, $\beta = .079$, $p = .038$, and depression, $\beta = -.140$, $p = .003$, through the mediator, locomotion.

Significant indirect effects of neuroticism on stress, $\beta = .086$, $p = .022$, and anxiety, $\beta = .101$, $p = .027$, were observed. Further analyses indicated that prevention partially mediated both of these effects, with prevention as a significant mediator for the effect of neuroticism on stress, $\beta = .024$, $p = .009$, and a marginally significant mediator for the effect of neuroticism on anxiety, $\beta = .024$, $p = .082$.

Similarly, there were also significant indirect effects of GEC on stress, $\beta = .046$, $p = .023$, and anxiety, $\beta = .049$, $p = .042$. Again, prevention was a significant partial mediator for the effect of GEC on stress, $\beta = .007$, $p = .045$, and a marginally significant mediator for the effect of GEC on anxiety, $\beta = .006$, $p = .082$.

To summarize, it was observed that GEC impacted both stress and anxiety, with better EF (or lower GEC) predicting lower negative affect; the effect of GEC on stress was mediated by prevention behaviours, with higher prevention predicting lower levels of stress. Similarly, neuroticism positively predicted all measures of affect, and prevention again mediated the effect of neuroticism on stress and anxiety; less prevention predicted higher levels of stress and anxiety. Finally, grit indirectly impacted stress and depression through locomotion; higher levels of locomotion predicted lower depression, but higher stress.

Outcome Measures: GPA. Within the questionnaire, participants were asked to indicate their first year and cumulative GPAs and the importance of grades to themselves and their families. However, these ratings did not end up correlating with either GPA (all p's > .10). As such, the measures of importance of grades were not included in the final model. Additionally, two separate models were run, one examining first year GPA, and the other examining cumulative GPA. Again, in order to examine indirect effects, bootstrapping was used with 2000 bootstrapped samples specified for both models.

The method to examine the outcome measure of GPA was similar to that used for examining affect. We again began with the model from the basic extension (see Figure 4), and had the three predictor variables and four goal behaviours predict first year GPA. None of the terms were dropped, and the final model (omitting the beta values and covariances displayed in Figure 4, for visual simplicity) can be seen in Figure 6.

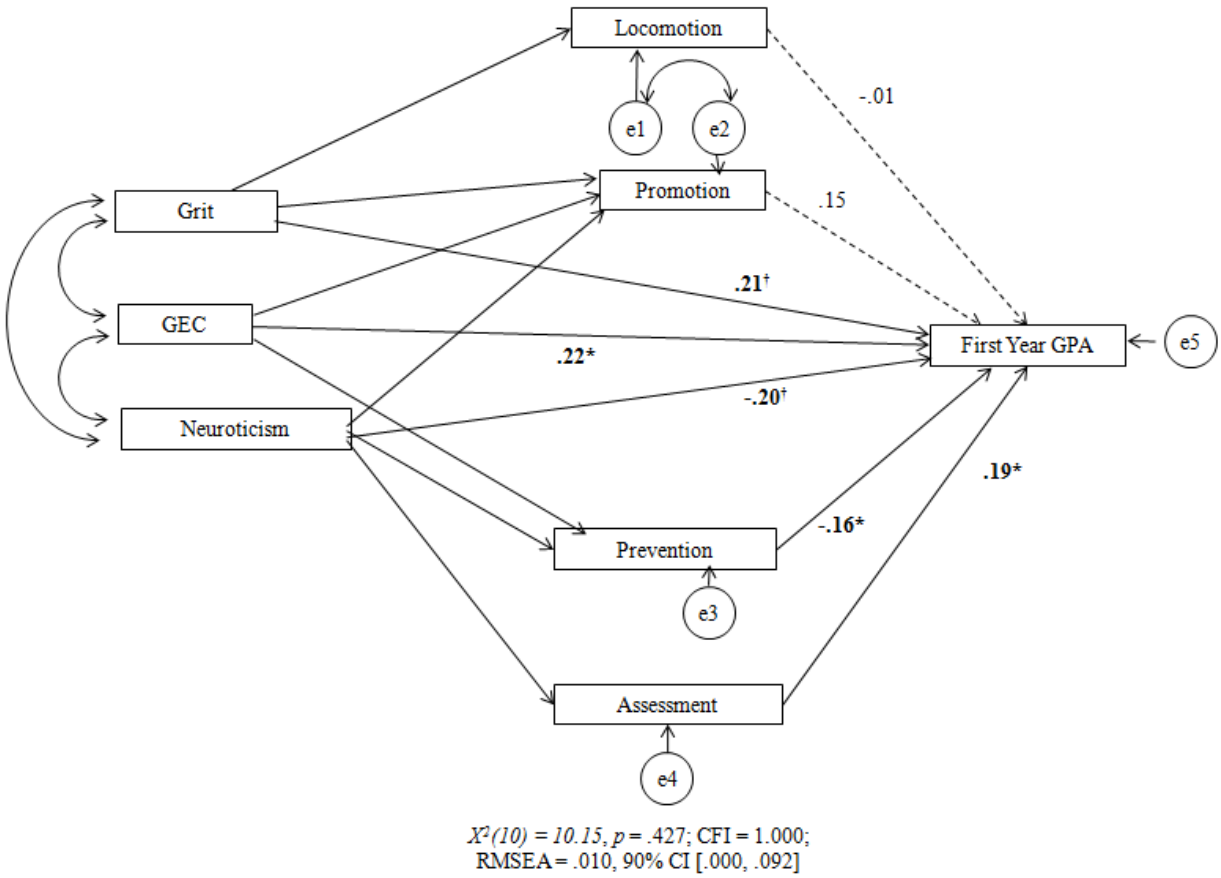

Figure 6 Regression model for Study 2 indicating first year GPA outcome variable.
†*p* < .10; *p < .05; **p < .01; ***p < .001

Assessment and prevention were significant predictors of first year average, but in a direction opposite of what might be expected. Higher assessment predicted higher GPA, β = .19, p = .022, whereas higher prevention predicted lower GPA, β = -.16, p = .049. Furthermore, all three predictor variables directly impacted first year GPA, though again, not all in a way that would be anticipated. Unsurprisingly, higher grit marginally predicted higher GPA, β = .21, p = .065, and higher neuroticism marginally predicted lower GPA; β = -.20, p = .058. Interestingly, GEC was a positive predictor of GPA, β = .22, p = .030; that is, higher GEC (and thus *worse* EF) was predictive of higher GPA in the first year of university. All indirect effects of GEC, grit, and neuroticism on first year GPA were not significant, all p's > .10.

We then examined the outcome variable of cumulative GPA, in order to determine if the impact of the predictors and behaviours change over time. The same method was used when examining first year GPA. Since GEC, grit, and neuroticism all did not directly predict GPA, all non-significant terms were dropped from the model. The final model is displayed in Figure 7 (omitting beta values previously displayed in Figure 4).

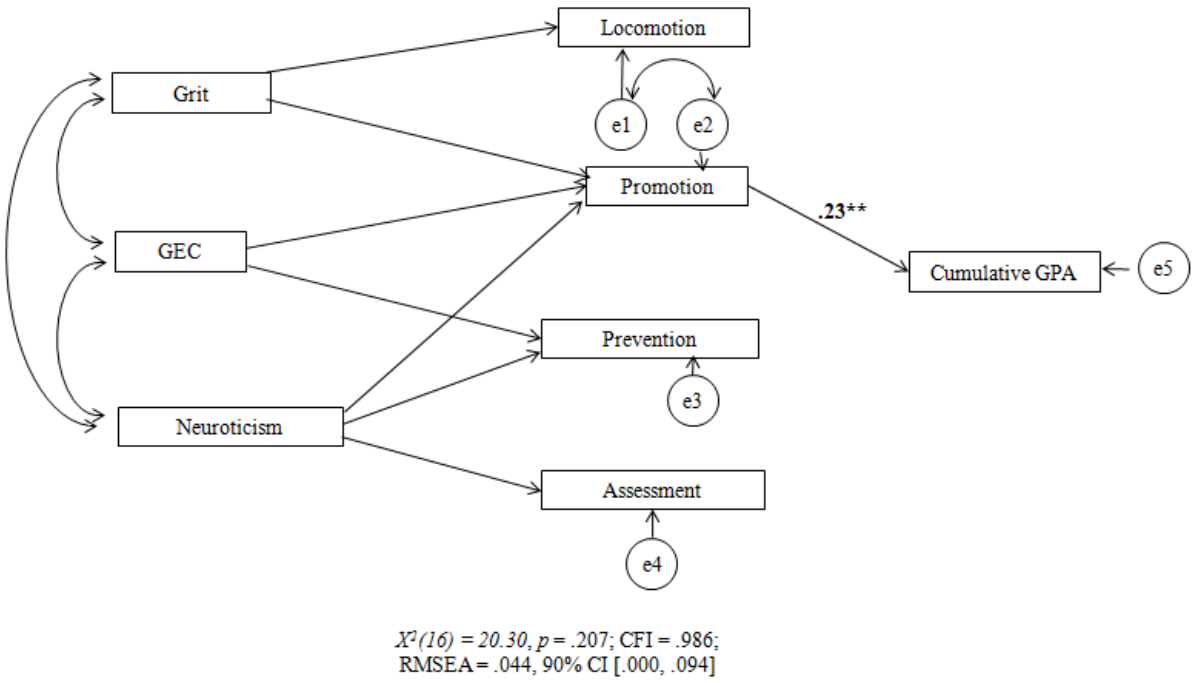

Figure 7 Regression model for Study 2 indicating cumulative GPA outcome variable.
*$p < .05$; **$p < .01$; ***$p < .001$*

Surprisingly, the only significant predictor of cumulative GPA was promotion, $\beta = .23$, $p = .006$. Additionally, the indirect effects of GEC, $\beta = -.045$, grit, $\beta = .070$, and neuroticism, $\beta = -.070$, were all significant, all p's = .001, with higher grit, better EF (or lower GEC), and lower neuroticism predicting higher GPA through their effects on the mediator, promotion. Overall, it is clear that in the current sample, promotion behaviours are the most important factor in predicting cumulative GPA.

Discussion

In Study 2, it was again observed that EF and grit, while being related, impact goal-motivated behaviours differently. First, the results of Study 1 were partially replicated, demonstrating that higher levels of grit predict a greater frequency of promotion and locomotion behaviours, and better EF predicts more prevention behaviours. In the current sample, better EF also predicted more promotion behaviours. Most notably, assessment was not predicted by EF, grit, or the interaction between the two in this sample of participants; rather, neuroticism alone positively predicted assessment behaviours. Finally, neuroticism was also observed to predict promotion and prevention, with lower neuroticism leading to more promotion and prevention behaviours. Overall, these results confirm the notion that grit influences behaviours that directly lead to goal enhancement, whereas the avoidance of behaviours that impede with goal achievement may be more directed by EF. Additionally, the impact of EF and grit on assessment behaviours remains unclear, though the current results may indicate that the relationship between these constructs may be tenuous. Finally, higher neuroticism appears to increase assessment behaviours, which do not themselves lead to goal completion, whereas lower neuroticism influences goal behaviours more known to lead to goal achievement on their own (i.e., promotion and prevention).

In an expansion of the basic regression model, it was observed that higher neuroticism and GEC both predicted greater anxiety and stress; these effects were partially mediated through prevention behaviours. There was also a positive direct effect of neuroticism on depression. Finally, locomotion negatively predicted depression and positively predicted stress. These findings indicate that negative affect is predicted both by broader measures such as neuroticism and EF, as well as by the behaviours that may arise as a result of those broader factors.

Interestingly, promotion behaviours were the only type of self-regulatory behavior that predicted cumulative GPA, with more promotion behaviours predicting higher cumulative GPA. GEC, grit, and neuroticism indirectly impacted cumulative GPA via promotion behaviours, with better EF, higher grit, and lower neuroticism predictive of higher grades. This finding may highlight the importance of promotion behaviours in achieving academic goals in the long-term. The examination of first year GPA revealed very different findings. In this case, lower neuroticism, higher grit, and *worse* EF all directly predicted higher grades. Furthermore, prevention was a negative predictor of first year GPA, whereas assessment was a positive predictor. These findings seem to indicate that in a time of transition, perseverance and resilience in stressful situations are particularly helpful to goal attainment. Furthermore, the results of Study 2 suggest that in this turbulent period, lower EF may be beneficial to goal attainment; it is less clear why this may be the case. It should be noted that this finding is quite inconsistent with previous work, and as such, may not be wholly reliable. Future work should aim to replicate this finding to better understand the relationship between EF and first year versus cumulative GPA.

Overall, these findings may point to promotion, locomotion, and prevention being goal-motivated behaviours that arise from more desirable traits (e.g., lower neuroticism, higher grit, and better EF), and generally result in more positive outcomes (e.g., lower psychopathology and higher grades). On the other hand, consistent with previous reports from the literature, assessment on its own may be a less-productive behaviour to engage in consistently, as these behaviours seem to be associated with greater levels of psychopathology.

General Discussion

The overall purpose of the presented set of studies was to better examine the impact of EF and grit on distinct goal-motivated behaviours (i.e., promotion, prevention, locomotion, and

assessment). Additionally, in the second study, we were interested in observing how neuroticism impacts those behaviours, and how those behaviours impact levels of stress, depression, anxiety, and GPA.

Across both studies, it was observed that grit positively predicted promotion and locomotion behaviours (both of which involve action in order to pursue a goal), whereas GEC negatively predicted prevention behaviours (which involves avoiding unproductive action that may prevent goal achievement). It may be the case that grit, which describes perseverance and motivation, is important in promoting behaviours that involve action, as people with higher grit are particularly concerned with movement toward goal attainment. This finding is consistent with related findings in the literature (Crowe & Higgins, 1997; Pierro et al., 2011). On the other hand, EF may be more influential on a prevention focus of safety and responsibility, as these behaviours may require more executive control in order to be achieved. The current investigation suggests a reliable pattern in which grit and EF differentially predict these three different goal-related behaviours.

The difference in findings between the two studies on how grit and EF influence assessment behaviours was quite striking. In Study 1, assessment (which is evaluating all options thoroughly before choosing one to pursue a goal) was predicted by the interaction between grit and GEC. Further examination revealed that for those with high levels of grit, poorer EF predicted more assessment behaviours. We proposed that this may reflect that those higher in grit engage in assessment as they want to succeed, but poor EF makes it difficult for them to actually initiate a plan. However, in Study 2, assessment was not predicted by GEC, grit, or the interaction term at all, but rather was solely predicted by neuroticism. When the items from the assessment scale are closely examined, this finding on its own is not particularly surprising.

Although the scale is meant to reflect evaluative thinking around goal achievement, the questions seem to ask about social anxiety and ruminative thinking (e.g., "I often feel I am being evaluated by others"; "I rarely analyze the conversations I have had with others after they occur"), or judgement of others (e.g., "I often think that other people's choices and decisions are wrong"; "I am a critical person"). Given that this scale does not directly ask about evaluating choices to achieve a goal, but rather evaluation of self and others, it is not wholly surprising that assessment was predicted by neuroticism and not EF and grit in Study 2. However, it is still unclear why the interaction term between grit and GEC was significant in predicting assessment in Study 1. Again, future studies can aim to better determine how EF and grit impact assessment behaviours as evaluated by the RMQ, if at all. Furthermore, it may be worthwhile to return to the development of the RMQ in order to ensure that assessment behaviours, as defined by Kruglanski et al. (2000), are validly measured.

In terms of outcome measures, it was found that neuroticism and GEC (executive dysfunction) positively predicted levels of stress, anxiety, and depression; these findings are consistent with what is reported in the literature (Snyder et al., 2015). Additionally, prevention mediated the effects on stress and anxiety for both EF and neuroticism. It seems that for those with poor EF and high neuroticism, engaging in prevention behaviours may be a protective factor, as these behaviours negatively predicted stress and anxiety. That is, a focus on safety and responsibility that allows for goal attainment may help to reduce feelings of stress and anxiety for those with poor EF and higher levels of neuroticism, as well as lead to lower stress and anxiety overall. Consistent with the literature, locomotion predicted lower levels of depression (Hong et al., 2004; Kruglanski et al., 2000), but surprisingly, locomotion also predicted higher levels of stress. It is possible that, because locomotion behaviours do not involve fully thinking

plans through, that high locomotors are more likely to end up in stressful situations that could have been easily avoided compared to low locomotors. Further work will need to be done to replicate and better elucidate this finding.

A more objective outcome measure included in the study was GPA. This measure was used since within an undergraduate sample, obtaining high grades is a common goal. When measuring first year average, it seems that higher grit, lower neuroticism, and worse EF led to higher grades. It is possible that during transitory periods, these more consistent traits and abilities are particularly impactful on success. It is easy to imagine how higher grit and lower neuroticism would lead to higher first year GPA: in the stressful and difficult period of first year university, those who are more able to persevere and those that are less likely to be affected by stress may be more likely to succeed. However, it is unclear why worse EF would be beneficial to GPA. It is possible that individuals with better EF are more likely to be enrolled in faculties with lower grades overall (e.g., science, math, engineering). That said, within the current sample, post-hoc tests indicated that the only significant difference in GEC was between Applied Health Science and Engineering, with EF being *worse* for engineering students; moreover no difference in first year GPA was observed between the faculties. Therefore, this puzzling finding of worse EF leading to better grades does not seem to be an artefact of differences in ability between students enrolled in particular faculties. However, as mention above, this finding is very inconsistent with the extant literature, and may not be reliable. Future work should focus on replicating and further elucidating this finding in order to determine its reliability.

Surprisingly, only promotion predicted cumulative GPA, with higher promotion predicting higher GPA. This finding indicates that the system that is concerned with obtaining achievements (i.e., promotion) may be critical in actual academic success following the

transition period that entering university creates. Furthermore, significant indirect effects were observed, with higher grit, better EF, and lower neuroticism leading to higher GPA through the mediating effect of promotion. As in first year university, it seems that those who can persevere and who are less prone to stress are more likely to experience academic success. Furthermore, following the transition period of entering university, it appears that higher cognitive ability, unsurprisingly, leads to better grades. However, it is again important for this finding to be replicated in the future, along with other objective measures of achievement (both academic and otherwise) to fully understand how success is determined by the various goal motivated behaviours.

It should be noted that aside from first year GPA, grit did not directly predict any of the outcome measures used in this study, though it did indirectly predict stress, depression, and cumulative GPA through locomotion and promotion. It may be the case that grit in and of itself does not lead to success, but rather through the self-regulatory behaviours that arise from higher levels of grit. Future studies should aim to better elucidate the role of grit in goal achievement.

Limitations and Future Studies

A distinct limitation of the current investigation is the causal directionality suggested in a study that is correlational rather than longitudinal. The rationale behind this assumption of directionality was due to studies demonstrating that EF and personality are both evident early in development, and that individual differences in EF and personality are stable across time as well as highly impacted by genetics. These factors led us to believe that it is unlikely for behaviour to impact EF, grit, and neuroticism. However, as the current investigation is correlational in nature, it is important to address the possibility that the behaviours we engage in may have an influence on EF and personality. It may be the case that behaviours that lead to a change in state

(locomotion) or movement toward a goal (promotion) are likely to engender higher levels of grit within an individual. Furthermore, resisting temptations that may compromise goal achievement (prevention) may help to improve EF, as it allows for a chance to engage in important executive skills such as impulse control. Finally, engaging in highly evaluative behaviour may lead to higher levels of neuroticism through an analytical mindset. It will be important for future studies to explore the directionality of these relationships, and confirm that the early evidence for and stability of EF and personality traits does indeed make these factors influential in how we approach our goals.

Another striking limitation of the current study is the use of self-report measures. For the present purposes, the use of self-report measures was ideal—this was the first study to empirically examine how grit and EF impact goal-oriented behaviours, and the use of self-report allowed for a wide range of behaviours and traits to be examined. However, this also means that the data collected were not wholly objective. Additionally, as mentioned above, some of the scales used may not have been measuring goal-motivated behaviours, per se. While this study was certainly informative in indicating that grit and EF differentially affect distinct behaviours, more work needs to be done to further elucidate these findings.

Moving forward, it would be useful to use behavioural measures to examine how EF and grit affect goal motivated behaviours. There are a host of behavioural tasks that may be used to measure different aspects of EF (e.g., Eriksen & Eriksen, 1974; Oswald, McAbee, Redick, & Hambrick, 2014; Spector & Biederman, 1976; Wechsler, 2008). Additionally, there are impossible tasks that have been developed, with the idea being that a longer period of time attempting the task reflects higher levels of perseverance (e.g., Crowe & Higgins, 1997); these tasks may provide a behavioural measure of grit. By using these tasks to measure EF and grit

behaviourally, it would be possible to examine how they impact performance on other tasks developed within the goal motivation literature (e.g., Schmidt & DeShon, 2007). This would further our understanding of how EF and grit impact successful goal-oriented behaviours.

The use of an undergraduate sample is another limitation of the present study. Again, given the scope of this investigation, an undergraduate sample was useful to create a framework for how grit and EF influence goal behaviours. However, it is clear that both EF and grit develop and change across the lifespan (Duckworth et al., 2007; Duckworth & Quinn, 2009; Huizinga et al., 2006; McAuley & White, 2011; Miyake et al., 2000). Moving forward, it will be imperative to ensure that research examining how these constructs impact goal-motivated behaviours is conducted not just with undergraduates, but with both younger and older populations as well.

Conclusions

The current study indicates that EF, grit, and neuroticism are important factors that influence goal motivated behaviours. Grit appears to have a greater impact on behaviours involved with action to move toward a goal (i.e., promotion and locomotion), whereas EF may have a greater role in influencing behaviours that prevent a goal from being compromised (i.e., prevention). Finally, it seems that affect and GPA are directly affected by EF and grit, as well as indirectly through the self-regulatory behaviours EF and grit elicit. These findings indicate the importance of examining grit, EF, and goal behaviours in tandem, particularly when looking at various outcome variables, as examining only one of these factors may lead to an impoverished view of how goals are achieved.

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